

RES LIGUSTICAE CCLVI

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NOTES ON THE *REGALECUS GLESNE* OCCURRING IN
 THE GULF OF GENOVA AND IN LIGURO-PROVENÇAL
 WATERS (NW MEDITERRANEAN)

(PISCES, LAMPRIDIFORMES, REGALECIDAE)

INTRODUCTION

The king of herrings or oarfish *Regalecus glesne* Ascanius, 1772 is an open water mesopelagic fish occurring in all oceans, except in polar regions (OLNEY 1984). The species is characterised for having an extremely slender, laterally compressed, and very elongated body reaching lengths up to 17 m, and is considered the longest known teleost (ROBINS *et al.* 1986).

The genus *Regalecus* Ascanius, 1772 is generally treated as monotypic comprising a single biologically valid species *R. glesne* (HEEMSTRA 1986; PALMER 1986; NELSON 1994). However, Japanese and Mexican ichthyologists consistently report two other species of *Regalecus* occurring in the Pacific Ocean: *R. russelii* (Cuvier, 1816) and *R. kinoi* Castro-Aguirre *et al.*, 1991 (see FUJII 1984; CHAVEZ *et al.* 1985; CASTRO-AGUIRRE *et al.* 1991; RAMIREZ-MURILLO & SCHMIT-

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TER-SOTO 1996; BALART *et al.* 1999; SALAZAR-HERMOSO *et al.* 1999). Apparently these forms are distinguished from *R. glesne* on the basis of the following features: *R. kinoi* has a lesser number of rays either in the occipital crest or in the proper dorsal fin; it also possesses longer and typically lanceolated pectoral fins, a convex frontal margin of the head and a proportionally higher body. Whereas, *R. russelii* is principally distinguished from its congeners for having a larger number of gill rakers in the first gill arch (MORI 1956).

With the exception of the northern Adriatic Sea, *R. glesne* has been documented throughout the entire Mediterranean basin (FISCHER *et al.* 1987) and, wherever it occurs, the species is considered rare (TORTONESE 1970). However, in the Ligurian waters, the presence of this open water species is not exceptional and different documented instances of stranded or moribund specimens can be found in the scientific literature or in local journalistic articles (VINCIGUERRA 1918).

In this paper, data on the occurrence of the species in the Liguro-Provençal waters is overviewed taking into account historical and present literature as well as specimens preserved in systematic collections. The morphometric and meristic characters of a fresh specimen found in Arenzano harbour are compared with seven more or less complete individuals of *R. glesne* housed in the Museo Civico di Storia Naturale "G. Doria" of Genova (MSNG) and with one head stored in the "Dipartimento per lo Studio del Territorio e delle sue Risorse" of the University of Genova (Dip.Te.Ris.). Some information on the diet of Mediterranean oarfishes is also presented.

MATERIALS AND METHODS

Materials used in this study came from a wide variety of sources. Important data was obtained from extensive literature search, including journalistic articles and systematic collections. Records of oarfishes occurring in the Ligurian Sea and in the bordering localities of the French coast are summarized in Figure 1 and Table II.

Besides the fresh specimen collected at Arenzano (GE), 14.II.2003 (assigned to *R. glesne* and now in MSNG with catalogue number 53664), we disposed of seven liquid-stored examples housed in the Museum of Genova: MSNG 12306, Borghetto Santo Spirito (SV), 24.II.1906; MSNG 12307, Noli (SV), 10.V.1903; MSNG



Fig. 1 - Records of *Regalecus glesne* in the Liguro-Provençal waters according to Table II.

34931, Spotorno (SV), 28.VII.1950; MSNG 35367, Genova Prà (GE), 31.XII.1953; MSNG 54166, Santa Margherita Ligure (GE), 24.XI.1980; MSNG 54167, Sanremo (IM), 8.III.1992; MSNG 54168, Sanremo (IM), 18.IV.1993. The latter is represented only by the head and the extreme portion of the caudal end. Another individual, MSNG 37720, Genova Pegli (GE), 15.X.1959, was useless because cut into small pieces. Also some of the above cited specimens resulted problematic; in fact, due to extensive damage on the ventral side, the anal openings of the MSNG 35367, MSNG 54166 and MSNG 54167 specimens were not visible and parameters such as preanal and postanal lengths were not taken. Furthermore, during morphometric analyses on the MSNG 12306 specimen, we discovered that a large piece at mid-body was missing and that the anterior and posterior portions of the fish had been sewed back together, therefore, total length of the latter could only be estimated. According to body proportions measurements obtained from other samples of *Regalecus* examined in the present study, the postanal length of MSNG 12306 should have been 101.9 cm, which means that the missing piece was at least 47.7 cm; the biometric proportions were calculated in accordance to the following adjustment of total length: $TL = \text{preanal length (original)} + \text{postanal length (estimated)}$, that is to say $53 + 101.9 = 154.9$ cm (see Table I). We also examined the head of a specimen from Sanremo (IM), 19.II.1998 at present stored in the University of Genova (Dip.Te.Ris).

Tab. I – Absolute (cm) and proportional measurements expressed as percentage (%) of total length (TL) and head length (HL) of the Arenzano specimen (MSNG 53664) of *Regalecus glesne* compared with the ones of eight individuals of the species preserved in MSNG and Dip.Te.Ris.. Some

		Noli 10.V.1903 MSNG 12307			Borghetto Santo Spirito 24.II.1906 MSNG 12306		
		absolute	%TL	%HL	absolute	%TL	%HL
1	total length (TL)	118.0		1864%	(154.9)		1702%
2	preanal length	39.8	33.7%	629%	53.0	34.2%	582%
3	predorsal length	1.2	1.0%	19%	2.0	1.3%	22%
4	postanal length	78.2	66.3%	1235%	(101.9)	65.8%	1120%
5	prepelvic length	6.5	5.5%	103%	11.6	7.5%	127%
6	head length (HL)	6.3	5.4%		9.1	5.9%	
7	head height (through center of eye)	5.0	4.3%	80%	8.4	5.4%	92%
8	body height (at posterior margin of opercle)	4.8	4.0%	75%	8.1	5.2%	89%
9	body height (at anus)	3.2	2.7%	51%	7.1	4.6%	78%
10	preorbital length	1.5	1.2%	23%	2.5	1.6%	27%
11	supraorbital length	1.2	1.0%	19%	2.4	1.5%	26%
12	postorbital length	117.0	99.2%	1848%	(150.9)	97.4%	1658%
13	suborbital length	2.1	1.8%	33%	4.0	2.6%	44%
14	greatest body height	5.1	4.4%	81%	7.6	4.9%	84%
15	ocular diameter vertical	1.6	1.3%	24%	1.9	1.2%	21%
16	ocular diameter horizontal	1.7	1.4%	26%	1.9	1.2%	21%
17	interorbital space	1.2	1.0%	19%	1.4	0.9%	15%
18	internarial space	0.4	0.3%	6%	NM		
19	preopercular max height (vertical)	2.3	1.9%	36%	3.2	2.1%	35%
20	preopercular max length (diagonal)	4.2	3.5%	66%	5.3	3.4%	58%
21	opercular max height	2.5	2.2%	40%	4.1	2.6%	45%
22	maxillary length	2.3	2.0%	37%	3.9	2.5%	43%
23	maxillary width	0.8	0.7%	13%	1.5	1.0%	16%
24	pectoral fin lenght	NM			2.9	1.9%	32%
25	pectoral fin base lenght	0.8	0.7%	12%	1.2	0.8%	13%
26	max dorsal fin height (excluded occipital crest)	3.2	2.7%	51%	3.7	2.4%	41%
27	pelvic fin lenght (including distal lobes)	32.7	27.7%	517%	53.0	34.2%	582%
a	first gill arch lenght	3.2	3.2%	59.7%	4.6	3.0%	50.5%
b	longest gill filament	1.0	0.8%	15.2%	1.5	1.0%	16.5%
c	shortest gill filament	0.3	0.2%	4.1%	0.4	0.3%	4.4%
d	longest gillraker	0.6	0.6%	11.4%	1.0	0.6%	11.0%
e	gillrakers on the first arch	8+35=43			7+32=39		
f	number of rays in occipital crest	5+7=12			5+7=12		
g	total dorsal rays (occipital crest included)	397			164		
h	total dorsal rays up to anal opening	105			99		
i	caudal fin rays	0			0		
j	pectoral fin rays	13			12		
k	teeth upper jaw	6-7			0		
l	teeth lower jaw	6-7			barely perceivable		
m	forehead shape	slightly concave			concave		
n	caudal end	intact			mutilated		
o	spiny nubbins on caudal tip	5			NM		
p	pseudobranch	yes			yes		
q	small rakers between larger ones	no			yes		

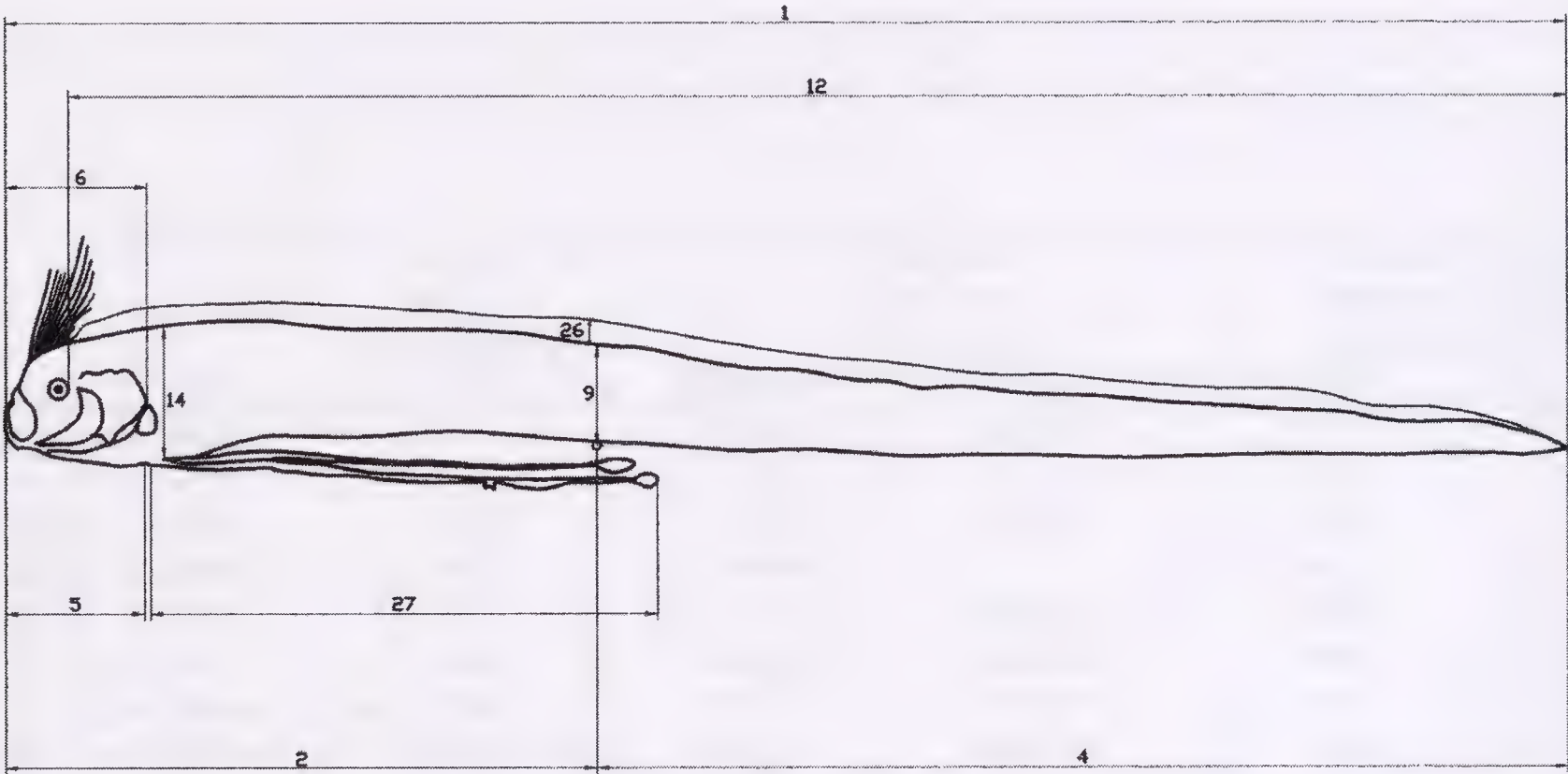
meristic and morphological characters are also given. †Total length of the Arenzano and Sanremo specimens measured in the laboratory. *Capture data. Estimated values are presented in parentheses. NM: parameter not measurable.

Spotorno 28.VII.1950 MSNG 34931			Genova Prà 31.XII.1953 MSNG 35367			Santa Margherita Ligure 24.XI.1980 MSNG 54166			
absolute	%TL	%HL	absolute	%TL	%HL	absolute	%TL	%HL	
180.4		1611%	258.0		2043%	86.5		2109.8%	1
64.5	35.8%	576%	NM			NM			2
1.8	1.0%	16%	3.1	1.2%	24%	0.9	1.0%	22.0%	3
115.2	63.9%	1029%	NM			NM			4
13.5	7.5%	121%	15.0	5.8%	119%	5	5.8%	122.0%	5
11.2	6.2%		12.6	4.9%	100%	4.1	4.7%		6
9.4	5.2%	83%	11.8	4.6%	93%	3.3	3.8%	80.5%	7
11.1	6.1%	99%	12.3	4.8%	98%	3.5	4.0%	85.4%	8
9.5	5.3%	85%	NM			NM			9
3.2	1.8%	29%	4.3	1.7%	34.1%	0.8	0.9%	19.5%	10
3.3	1.8%	30%	4.0	1.5%	31%	1	1.2%	24.4%	11
175.1	97.1%	1563%	251.5	97.5%	1992%	84.5	97.7%	2061.0%	12
4.3	2.4%	38%	5.8	2.3%	46%	1.5	1.7%	36.6%	13
11.0	6.1%	98%	12.7	4.9%	100%	3.4	3.9%	82.9%	14
2.3	1.2%	20%	2.9	1.1%	23%	1	1.2%	24.4%	15
2.3	1.2%	20%	3.0	1.1%	23%	1	1.2%	24.4%	16
2.0	1.1%	18%	2.3	0.9%	18%	0.7	0.8%	17.1%	17
0.7	0.4%	6%	1.0	0.4%	8%	0.4	0.5%	9.8%	18
4.2	2.4%	38%	5.1	2.0%	40%	1.9	2.2%	46.3%	19
6.9	3.8%	61%	7.9	3.1%	63%	2.8	3.2%	68.3%	20
4.0	2.2%	35%	6.3	2.4%	50%	1.8	2.1%	43.9%	21
4.2	2.3%	37%	5.0	1.9%	39%	1.8	2.1%	43.9%	22
1.9	1.0%	17%	2.2	0.8%	17%	0.9	1.0%	22.0%	23
3.3	1.8%	29%	4.3	1.7%	34%	0.8	0.9%	19.5%	24
1.6	0.9%	14%	1.6	0.6%	13%	0.6	0.7%	14.6%	25
NM			NM			2.6	3.0%	63.4%	26
NM			NM			NM			27
5.6	3.1%	50.0%	6.4	2.5%	50.7%	2.4	2.8%	58.5%	a
1.9	1.1%	17.0%	2.0	0.8%	15.8%	0.7	0.8%	17.1%	b
1.0	0.6%	8.9%	0.5	0.2%	4.0%	0.2	0.2%	4.9%	c
1.4	0.8%	12.5%	1.8	0.7%	14.3%	0.3	0.3%	7.3%	d
8+33=41			7+36=43			7+32=39			e
NM			NM			NM			f
260			366			359			g
106			NM			NM			h
0			0			0			i
11			11-12			12			j
0			9-10			0			k
0			5			4			l
strongly concave			slightly concave			concave			m
mutilated			mutilated			intact			n
NM			NM			4			o
yes			yes			yes			p
yes			yes			no			q

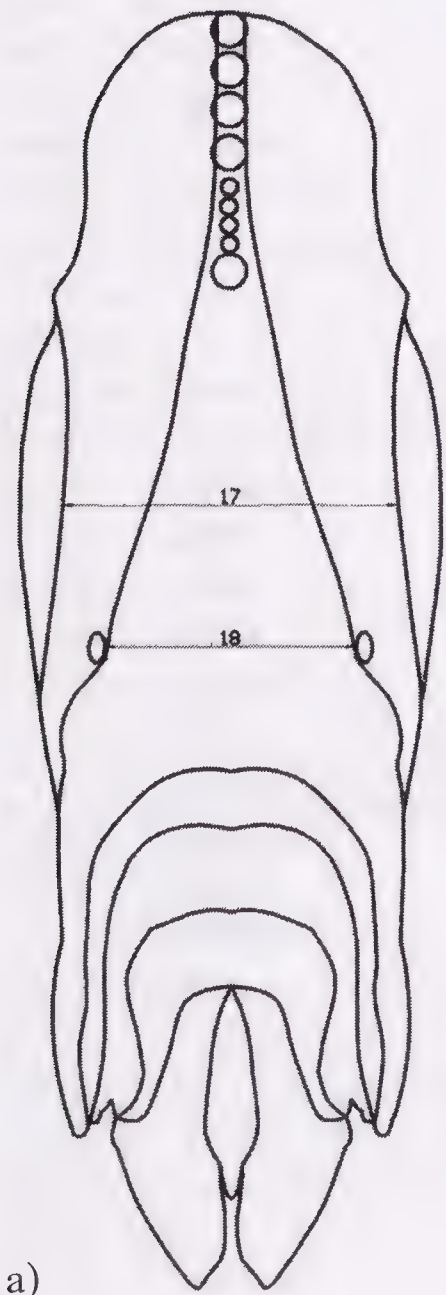
Tab. I (cont.)

		Sanremo 8.III.1992 MSNG 54167			Sanremo 18.IV.1993 MSNG 54168		
		absolute	%TL	%HL	absolute	%TL	%HL
1	total length (TL)	340†			433*		2353.3%
2	preanal length	NM			NM		
3	predorsal length	NM			NM		
4	postanal length	NM			NM		
5	prepelvic length	NM			NM		
6	head length (HL)	NM			18.4	4.2%	100.0%
7	head height (through center of eye)	15.5	4.56%		15.5	3.6%	84.2%
8	body height (at posterior margin of opercle)	16	4.71%		18	4.2%	97.8%
9	body height (at anus)	NM			NM		
10	preorbital length	NM			4	0.9%	21.7%
11	supraorbital length	4.1	1.21%		5	1.2%	27.2%
12	postorbital length	330	97.06%		NM		
13	suborbital length	8	2.35%		5.5	1.3%	29.9%
14	greatest body height	NM			NM		
15	ocular diameter vertical	3.3	0.97%		4.6	1.1%	25.0%
16	ocular diameter horizontal	3.3	0.97%		4.6	1.1%	25.0%
17	interorbital space	2.9	0.85%		3.7	0.9%	20.1%
18	internarial space	NM			1.5	0.3%	8.2%
19	preopercular max height (vertical)	5.7	1.68%		6.4	1.5%	34.8%
20	preopercular max length (diagonal)	9.5	2.79%		11.3	2.6%	61.4%
21	opercular max height	5.9	1.74%		6.1	1.4%	33.2%
22	maxillary length	5.8	1.71%		6.1	1.4%	33.2%
23	maxillary width	2.6	0.76%		2.6	0.6%	14.1%
24	pectoral fin lenght	5	1.47%		5.6	1.3%	30.4%
25	pectoral fin base lenght	2.4	0.71%		2.7	0.6%	14.7%
26	max dorsal fin height (excluded occipital crest)	6.6	1.94%		NM		
27	pelvic fin lenght (including distal lobes)	NM			NM		
a	first gill arch lenght	8.9	2.62%		9.3	2.1%	50.5%
b	longest gill filament	2.8	0.82%		2.7	0.6%	14.7%
c	shortest gill filament	0.4	0.12%		0.3	0.1%	1.6%
d	longest gillraker	1.8	0.53%		1.9	0.4%	10.3%
e	gillrakers on the first arch	8+29=37			9+33=42		
f	number of rays in occipital crest	NM			NM		
g	total dorsal rays (occipital crest included)	394			NM		
h	total dorsal rays up to anal opening	NM			NM		
i	caudal fin rays	0			NM		
j	pectoral fin rays	12			13		
k	teeth upper jaw	0			0		
l	teeth lower jaw	0			0		
m	forehead shape	concave			straight		
n	caudal end	intact			NM		
o	spiny nubbins on caudal tip	no			NM		
p	pseudobranch	yes			yes		
q	small rakers between larger ones	yes			yes		

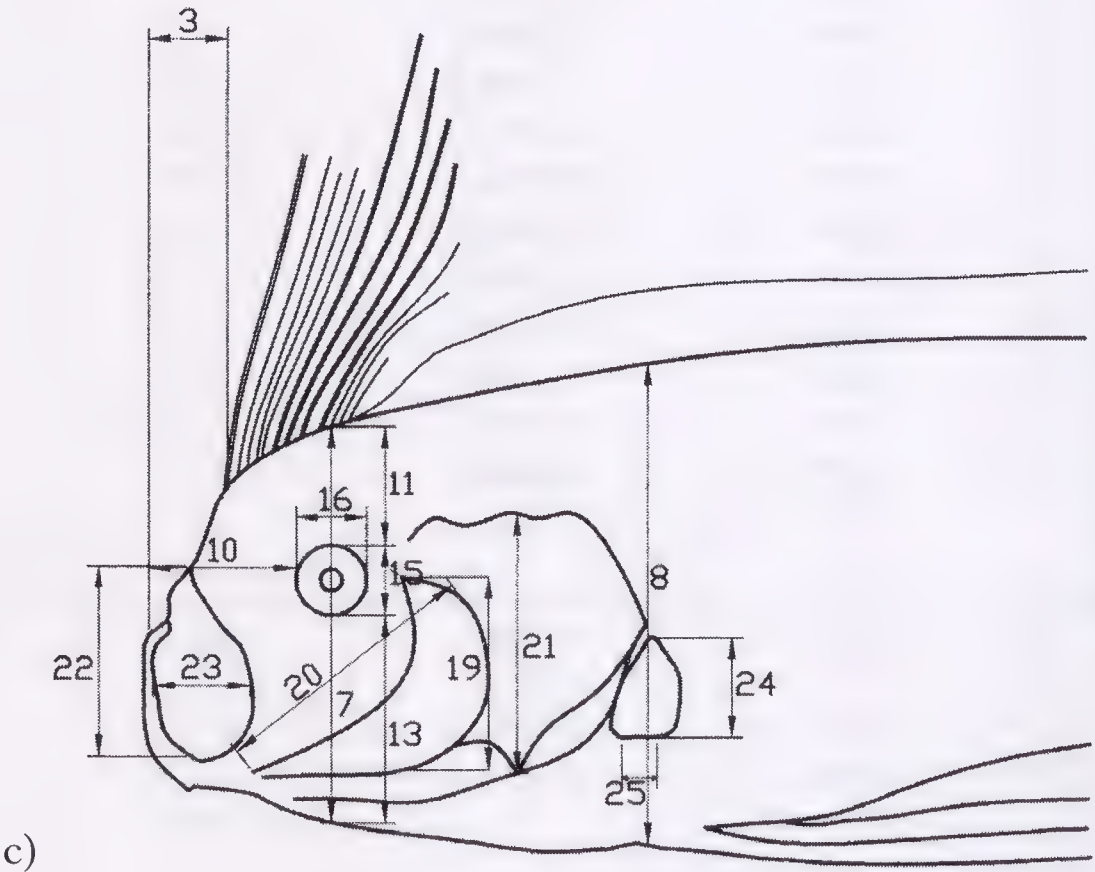
Sanremo 19.II.1998			Arenzano 14.II.2003			
absolute	Dip.Te.Ris. %TL	%HL	absolute	MSNG 53664 %TL	%HL	
206*		1271.60%	319†		2363%	1
NM			117.1	36.7%	867%	2
3.6	1.75%	22.22%	7	2.2%	52%	3
NM			201.9	63.3%	1496%	4
16.4	7.96%	101.23%	15	4.7%	111%	5
16.2	7.86%	100.00%	13.5	4.2%		6
13	6.31%	80.25%	13.5	4.2%	100%	7
14.1	6.84%	87.04%	16.5	5.2%	122%	8
NM			19	6.0%	141%	9
4.1	1.99%	25.31%	5.5	1.7%	41%	10
4.4	2.14%	27.16%	5	1.6%	37%	11
NM			306.5	96.1%	2270%	12
5.2	2.52%	32.10%	4	1.3%	30%	13
NM			20.5	6.4%	152%	14
3.9	1.89%	24.07%	4	1.3%	30%	15
4	1.94%	24.69%	4	1.3%	30%	16
2.9	1.41%	17.90%	NM			17
0.9	0.44%	5.56%	NM			18
6.4	3.11%	39.51%	7.5	2.4%	56%	19
11	5.34%	67.90%	NM			20
7.6	3.69%	46.91%	7.0	2.2%	52%	21
5.9	2.86%	36.42%	6.0	1.9%	44%	22
2.5	1.21%	15.43%	3.0	0.9%	22%	23
4.6	2.23%	28.40%	5.2	1.6%	39%	24
2.2	1.07%	13.58%	2.0	0.6%	15%	25
NM			4.0	1.3%	30%	26
NM			NM			27
8	3.88%	49.38%	8.5	2.7%	63.0%	a
2.1	1.02%	12.96%	2.5	0.8%	18.5%	b
0.4	0.19%	2.47%	0.8	0.3%	5.9%	c
1.9	0.92%	11.73%	2.0	0.6%	14.8%	d
7+ 32=39			5+34=39			e
5+7=12			NM			f
NM			280			g
NM			111			h
NM			0			i
13			12			j
0			0			k
0			0			l
straight			strait			m
NM			mutilated			n
NM			NM			o
yes			yes			p
yes			yes			q



b)



a)



c)

Figure 2 – Morphometric characters used in this study shown on a generalized *Regalecus* silhouette depicted with a “classical” occipital crest (rays intentionally shortened).

- a) frontal view
- b) lateral view
- c) head measurements in detail

Morphometric and meristic analyses were carried out using 43 parameters extrapolated from different works on regalecids available in the scientific literature. Longitudinal measurements, e.g. distances from snout tip to various points along the body, were taken straight-line (between vertical projections to the horizontal axis of the body), made with a metal measuring tape and recorded to the nearest millimetre. All measurements used in the present study are shown in Figure 2 and Table I. Immediately after its finding, the Arenzano specimen was taken to ICRAM "Centro Raccolta Campioni Mar Ligure", divided in two halves and frozen at -20° C. Subsequently, in the laboratory the specimen was dissected in order to establish sex and to gather information on stomach contents and then deposited in MSNG.

RESULTS AND DISCUSSION

The fresh specimen of *R. glesne* from Arenzano was 330 cm total length (TL). When collected, the fish was still alive but showed visible signs of injury, probably caused by the impact with a boat propeller. Unfortunately, neither the elongated rays of the occipital crest nor the peculiar oar-shaped pelvic fins were intact. The Arenzano regalecid is described as follows.

Body long, ribbon-like covered with tubercles, which became more elevated along the abdomen especially behind the anus. Mouth small, vertical and protractible. Lateral line starts from above the eye, curves downwards and runs in a strait line along the lower quarter of the body. Four longitudinal ridges from head to tail. Greatest body depth in the middle of its length. Anus positioned in the anterior third of the body. Caudal extremity mutilated, showing a healed cicatrix. Gastric caecum extends well past the anus. Eyes rounded and fairly big. Nostrils single, on each side of the snout just behind maxillary symphysis. Pectoral fins lanceolated, inserted horizontally. Teeth absent. Gill rakers long with minute spines projecting on the inner and outer margins. Scales absent. Anal and caudal fins absent. Apparently eight rays on occipital crest (No.1: very stout; No.2: very slender; No.3 to No.6: nearly as thick as the first; No.7: slightly less stout than the former; No.8: slender like the second; No.9: not thicker than rays of proper dorsal fin); bases of anterior 6 dorsal rays closely set. Fin rays simple and unseg-

mented. Coloration: body silvery-grey with irregular oblique dark streaks and blotches especially in the first third of the body. Forehead, parts below edge of gill covers and sides of the mouth black. Pupil dark and iris light. Fins crimson red. Macroscopic examination of the gonads, allowed us to identify the specimen as a male. Stomach empty.

Measurements of total length obtained from the specimen in fresh conditions resulted quite discordant with the ones taken after a two year permanence in the freezing chamber of the laboratory (see Table II). Although the Arenzano specimen did not present the typical bluish streaks on head and body described in the literature (HEEMSTRA 1986), an irregular blue indigo spot above the eye is visible in two individuals found in Sanremo (Figure 3).



Figure 3 – Two individuals (from Sanremo) with irregular blue indigo spot above the eye.

Furthermore, we examined the stomach contents of two specimens (MSNG 54167 and Dip.Te.Ris. specimen); the stomach contents were exclusively made by crustacean remains: more in details, they consisted respectively of 43 heads and 7 individuals of the Mediterranean krill, *Meganyctiphanes norvegica* (M. Sars, 1857), in advanced digestive status; the identification was possible on the basis of mandibles and other rests.

The king of herrings or oarfish is apparently very rare in the Mediterranean (TORTONESE 1970). Its presence in this sea can be traced back to the XVI century, when IMPERATO (1599) figured and described a bizarre fish under the name of "*spada marina*" from the Gulf of Napoli (TORTONESE 1970). Eggs and young individuals at different stages of development have been collected in the Strait of Messina (MAZZARELLI 1910; SANZO 1925; SPARTÀ 1927; BERDAR *et al.* 1975; CAVALLARO *et al.* 1980) and Elba Island (DAMIANI 1913), but adults of the species have been rarely studied. As the synonymy clearly shows, various nominal species have been erroneously described during the XIX century by ichthyologists working on Mediterranean specimens (see RISSO 1826; CUVIER & VALENCIENNES 1835; GIGLIOLI 1880). The examples used by the above mentioned authors were mainly obtained from Nice (France) (VINCIGUERRA 1918). Also the Ligurian Sea is an extraordinary site for oarfish findings, as proven by the following records: Noli (ARIOLA 1904); Savona (MEZZANA 1909); Borghetto S. Spirito, Arenzano, Albissola, Santa Margherita Ligure (VINCIGUERRA 1918); Spotorno (GUIGLIA 1950). Furthermore, the following individuals, held in the museum of Genova, are not mentioned in the literature: MSNG 35367-Genova Prà; MSNG 37720-Genova Pegli; MSNG 54166-S. Margherita Ligure; MSNG 54167-Sanremo; MSNG 54168-Sanremo as well as two other specimens captured respectively in 1997 and 1998 off Sanremo (see Table II).

The biometric and meristic analyses conducted on the Arenzano specimen and on the examples of *R. glesne* held at MSNG and Dip.Te.Ris., confirmed the high individual variability in body proportions, already described by other authors (PARKER 1883; GOODE & BEAN 1896; HUTTON 1961). Proportional data in Table I shows anomalies essentially concentrated in two individuals: in the Arenzano specimen four measurements related to head length (HL) were greater than values obtained from other specimens examined

Table II – Records of *Regalecus glesne* from the Liguro-Provençal waters (in chronological order). * Data not available or not furnished by the author/s. + Not measurable. In parentheses, size (TL) of fresh specimen. Dip. Te.Ris.: Dipartimento per lo Studio del Territorio e delle sue Risorse, Università di Genova; MHNN: Muséum d'Histoire Naturelle de Nice; MNHN: Musée National d'Histoire Naturelle de Paris; MOM: Musée Océanographique de Monaco; MZUF: Museo di Storia Naturale, Sezione di Zoologia “La Specola”, Firenze; MSNG: Museo Civico di Storia Naturale “G. Doria”, Genova.

	Date of occurrence	No. specimens	Size TL (cm)	Locality of occurrence	Reference	Notes
1)	IV, V [ante 1826]	at least 2	~ 155	Nice (near the shore)	Risso (1826)	Drawings of caudal and ventral fins imaginary
2)	V.1830	3	~ 212 - 290	Nice (near the shore)	Cuvier & Valenciennes (1835)	MNHN A-7125, MNHN A-7126, MNHN A-7128
3)	1871	1	*	Nice		MNHN 000-6479
4)	18.VIII.1877	1	88	Nice	Giglioli (1880)	MZUF 886
5)	19.IV.1891	1	219	Nice	Damiani (1913)	MZUF 2762
6)	1896	1	99,5	Nice		MNHN 000-4466
7)	1897	1	300	Beaulieu Saint-Jean	Vayssiére (1917)	Probably MHNN
8)	10.V.1903	1	125	Noli	Ariola (1904)	MSNG 12307
9)	24.II.1906	1	108	Borghetto S. Spirito (stranded)	Vinciguerra (1918)	MSNG 12306
10)	24.I.1908	1	330	Arenzano (stranded)	Vinciguerra (1918)	Specimen not preserved
11)	17.VII.1909	2	288, 332	Savona (near the shore)	Mezzana (1909)	Specimens lost
12)	10.III.1910	1	300	Monaco (captured in the port)	Vayssiére (1917)	Probably MOM 91 1870 (cast specimen)
13)	13.IX.1913	1	110	Castiglioncello (near the shore)	Vinciguerra (1918)	Specimen not preserved
14)	20.VI.1915	1	325	Albissola (speared in shallow water)	Vinciguerra (1918)	Specimen not preserved
15)	12.II.1917	1	236	S. Margherita Ligure	Vinciguerra (1918)	Specimen lost
16)	19.II.1934	1	130 or 140	Monaco (captured in the port)		MOM 91 2349
17)	28.VII.1950	1	188	Spotorno	Guiglia (1950)	MSNG 34931
18)	31.XII.1953	1	258	Genova Prà		MSNG 35367
19)	15.X.1959	1	+	Genova Pegli		MSNG 37720
20)	24.XI.1980	1	86.5	S. Margherita Ligure (trawl-net)		MSNG 54166
21)	8.III.1992	1	340 (362)	Sanremo (trawl-net)		MSNG 54167
22)	18.IV.1993	1	433	Sanremo		MSNG 54168
23)	09.III.1994	1	197	La Formigue		MOM 91 3743
24)	12.IX.1997	1	145	Sanremo (trawl-net, depth -500 m)	Garibaldi (<i>in verbis</i>)	Specimen not preserved
25)	19.II.1998	1	206	Sanremo (surface)		Head preserved (Dip. Te.Ris)
26)	14.II.2003	1	319 (330)	Arenzano (near the shore)	Present paper	MSNG 53664

(Figure 4), and in the Sanremo Dip.Te.Ris specimen, five measurements related to total length (TL) resulted as well very high (Figure 5). Moreover dorsal fin ray counts in some specimens resulted also quite discordant (see Table I). These anomalies could be linked to a more or less degree of mutilation of the caudal end, which in regalecid fishes seems to occur quite often (VINCIGUERRA 1918). Also the poor condition of some examined individuals (including the Arenzano fish) may have contributed to cause these distortions. Furthermore, it must be said that TL measurement given for the Sanremo Dip.Te.Ris specimen was taken on the fresh animal (Garibaldi *in verbis*) while the biometric data here presented derives from measurements obtained from its preserved head.

Particularly interesting is the presence of teeth in the upper and lower jaws of four preserved specimens: in MSNG 12307 they are bigger and equally distributed around the symphysis of the dentary and premaxillary bones; in MSNG 35367 they are much smaller and more abundant on the premaxillary rather than on the dentary, while in MSNG 12306 and MSNG 54166 they are barely perceivable and located only around the symphysis of the dentary. The presence of teeth seems to be a variable character among oarfishes (TRUNOV & KUKUEV 2005). It is quite interesting to note that teeth have rarely been described for Indo-Pacific specimens of *Regalecus*, however, due to their diminutive size, teeth can be easily overlooked in these fishes.

Furthermore, some interesting observations regarding the morphology of the occipital crest in the oarfish was revealed during this study. As indicated by different authors, the number of elongated rays on the forehead of oarfishes, is to be considered a taxonomic character which distinguishes different species within the genus *Regalecus* (see CHAVEZ *et al.* 1985; CASTRO-AGUIRRE *et al.* 1991; RAMIREZ-MURILLO & SCHMITTER-SOTO 1996). However such information is not always available due to the intrinsic fragility of these structures which, in most studied specimens, appear seriously damaged. In the Arenzano fish, the precise number of elongated rays of the occipital crest can be only tentatively assessed, but valuable observations regarding their reciprocal thickness were made. In fact, the "classic" occipital crest morphology described in the literature is formed by twelve rays (HULLEY & RAU 1969), of which the first is very stout, the second, third, fourth and fifth are very slender

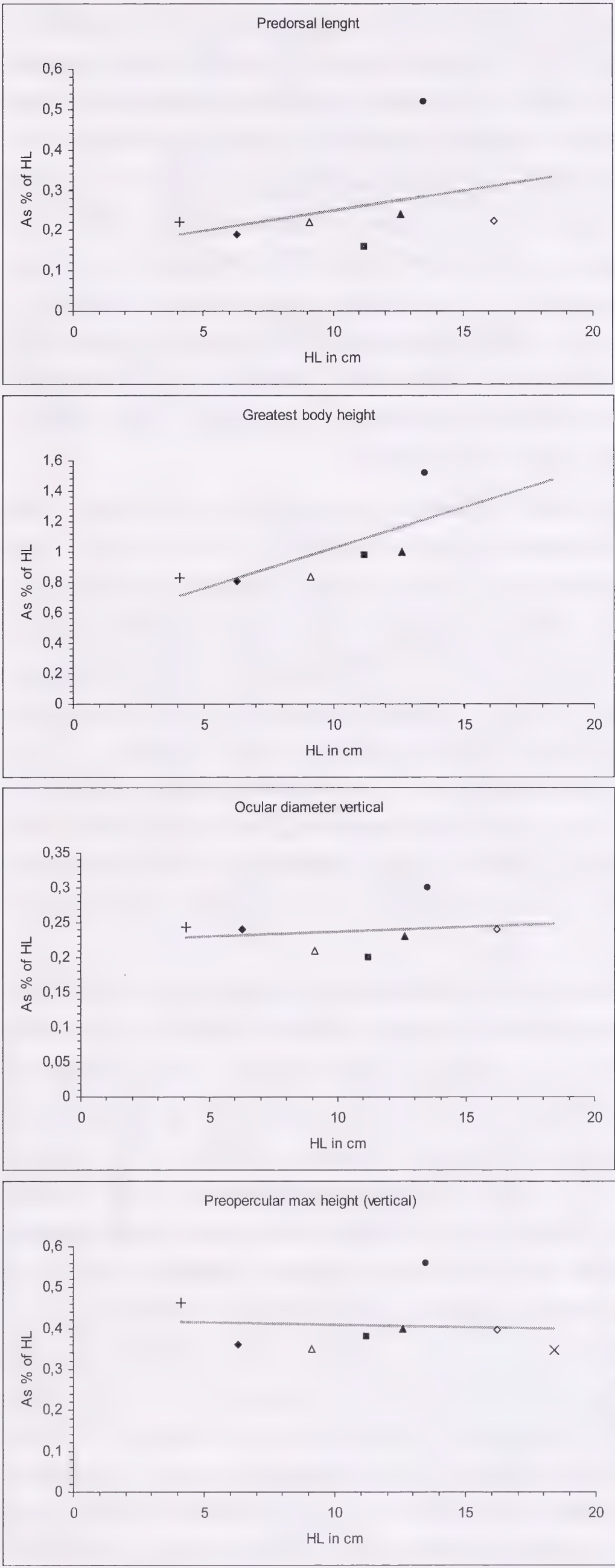


Figure 4 – Linear regression of four measurements related to head length.

- ◆ Noli (MSNG 12307);
- Spotorno (MSNG 34931);
- ▲ Genova Prà (MSNG 35367);
- Arenzano (MSNG 53664);
- △ Borghetto Santo Spirito (MSNG 12306);
- + Santa Margherita Ligure (MSNG 54166);
- × Sanremo (MSNG 54168);
- ◇ Sanremo (Dip.Te.Ris.).

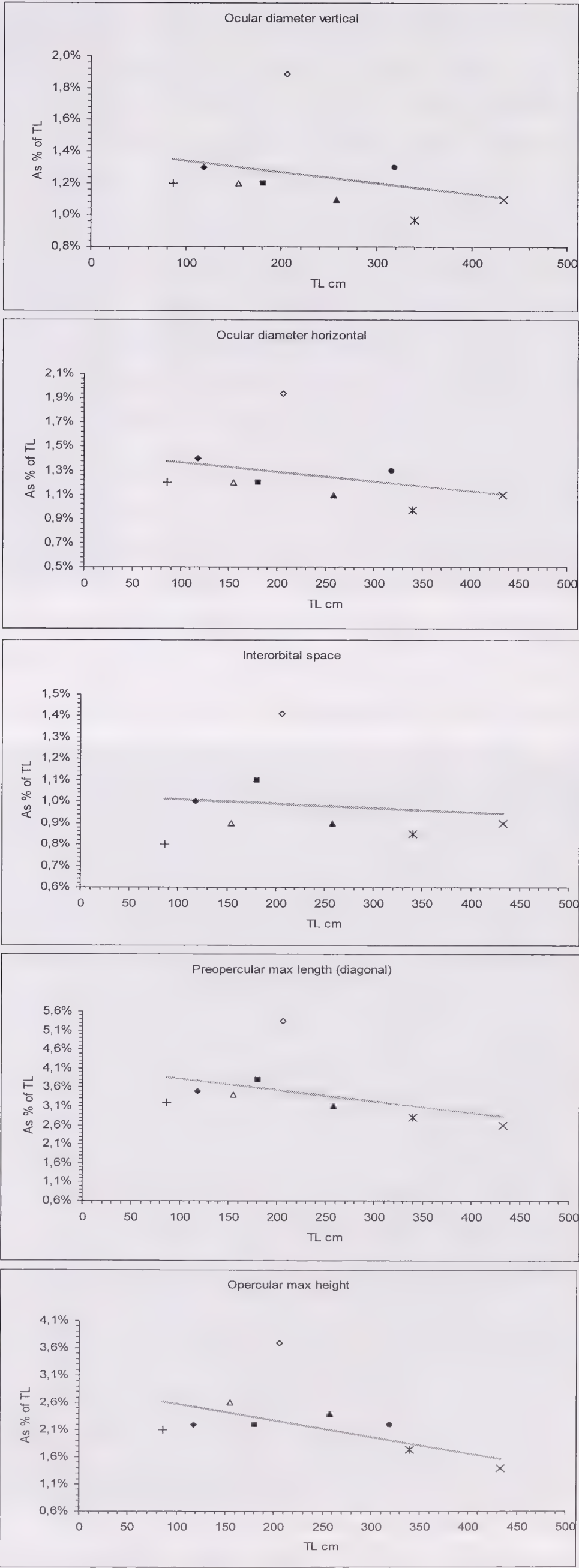


Figure 5 – Linear regression of five measurements related to total length.

- ◆ Noli (MSNG 12307);
- Spotorno (MSNG 34931);
- ▲ Genova Prà (MSNG 35367);
- Arenzano (MSNG 53664);
- △ Borghetto Santo Spirito (MSNG 12306);
- + Santa Margherita Ligure (MSNG 54166);
- × Sanremo (MSNG 54168);
- * Sanremo (MSNG 54167);
- ◇ Sanremo (Dip.Te.Ris.).

and the sixth, seventh, eighth and ninth are nearly as stout as the first, the remaining ones diminish in strength and become uniform in diameter with the proper dorsal fin rays. This kind of crest morphology was more or less observed in all liquid-stored specimens examined during the present study (see Figure 6). However, the *Regalecus* collected in Arenzano presents a different morphology of the occipital crest, which strongly differs from the classic descriptions, for having only one slender ray in position No. 2 (see Figure 7). To the best of our knowledge, a similar type of occipital crest morphology was described only once, for a large specimen stranded ashore in New Zealand (VON HAAST 1877).

Our study also revealed some incorrect biometric data furnished by VINCIGUERRA (1918) and re-proposed by GUIGLIA (1950) regarding preanal and postanal lengths of two individuals of *R. glesne* from Noli and Borghetto S. Spirito. For these two specimens, the preanal length is indicated as higher in respect to the postanal length, which must be considered erroneous since in this species the anus is positioned on the anterior third of the body (PALMER 1986).

The biometric analyses carried out on these two specimens of *R. glesne* during the present study, confirms only in part the inaccuracies given by the aforementioned authors. Infact, if for the Noli specimen there is an obvious mistake in the localization of the anal opening, for the Borghetto S. Spirito one, the measurements given by VINCIGUERRA (1918) are identical to ours and the biometric proportions are due to the fact that the specimen is missing the central portion of its body. It is possible, that the latter individual of *Regalecus* was taken to the museum incomplete by its finder and that the museum staff, unaware of this, sewed the animal back together. Since the latter was reassembled behind the anal opening, we were able to estimate the amount of body portion missing (see above, in Materials and Methods).

Comparatively to gill arch morphology, it is surprising that few or even any authors have put emphasis on the presence of very small additional rakers between each of the larger ones. These structures were observed on the first gill arch in all of our specimens, besides MSNG 12307 and MSNG 54166 which appeared devoid of them, even when investigated with a binocular microscope. Since the latter individuals are juveniles, the absence of additional rakers could be connected with a late development of these structures within the

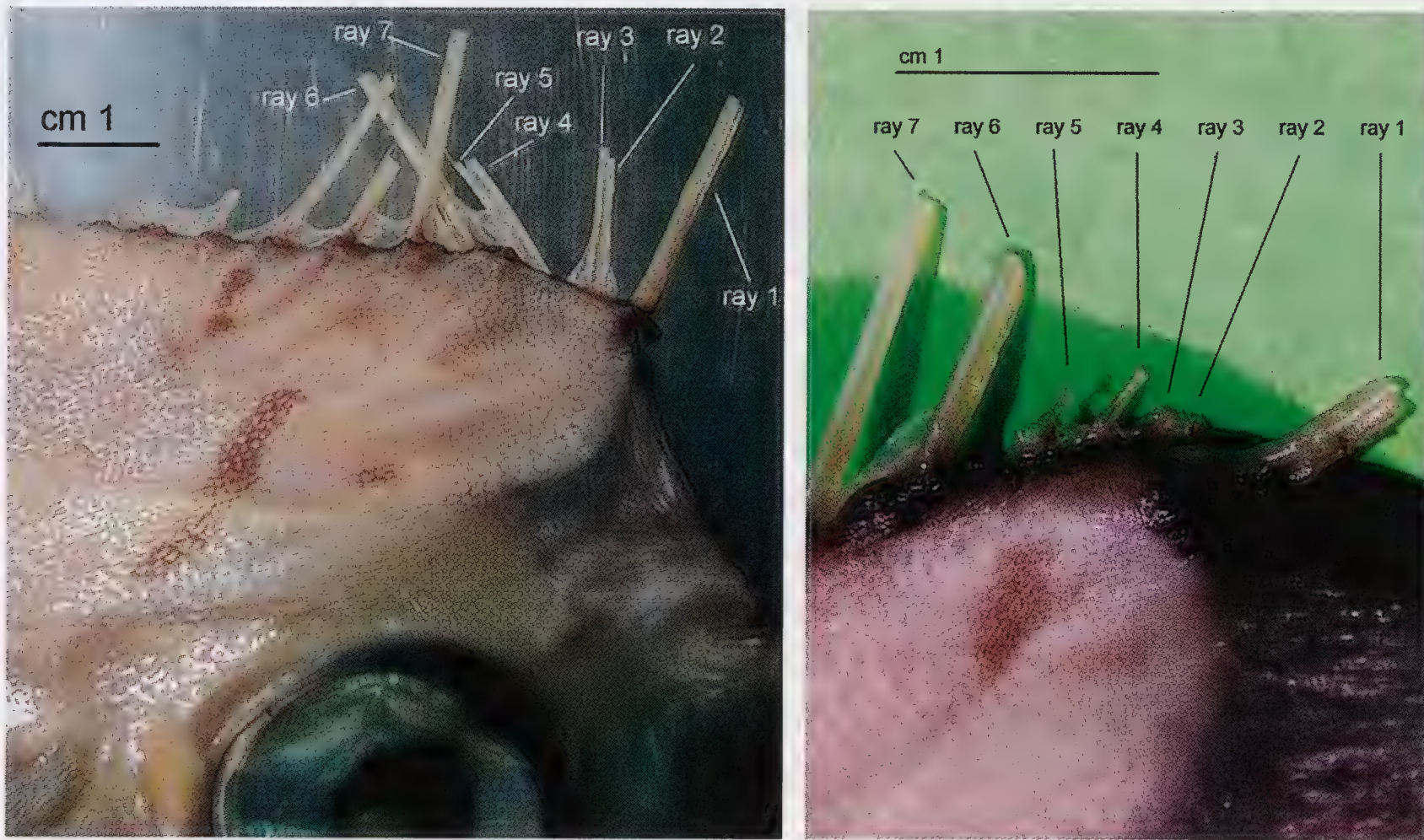


Figure 6 – Detail of the occipital crest in MSNG 35367 (Genova Prà) and MSNG 54168 (Sanremo) specimens.

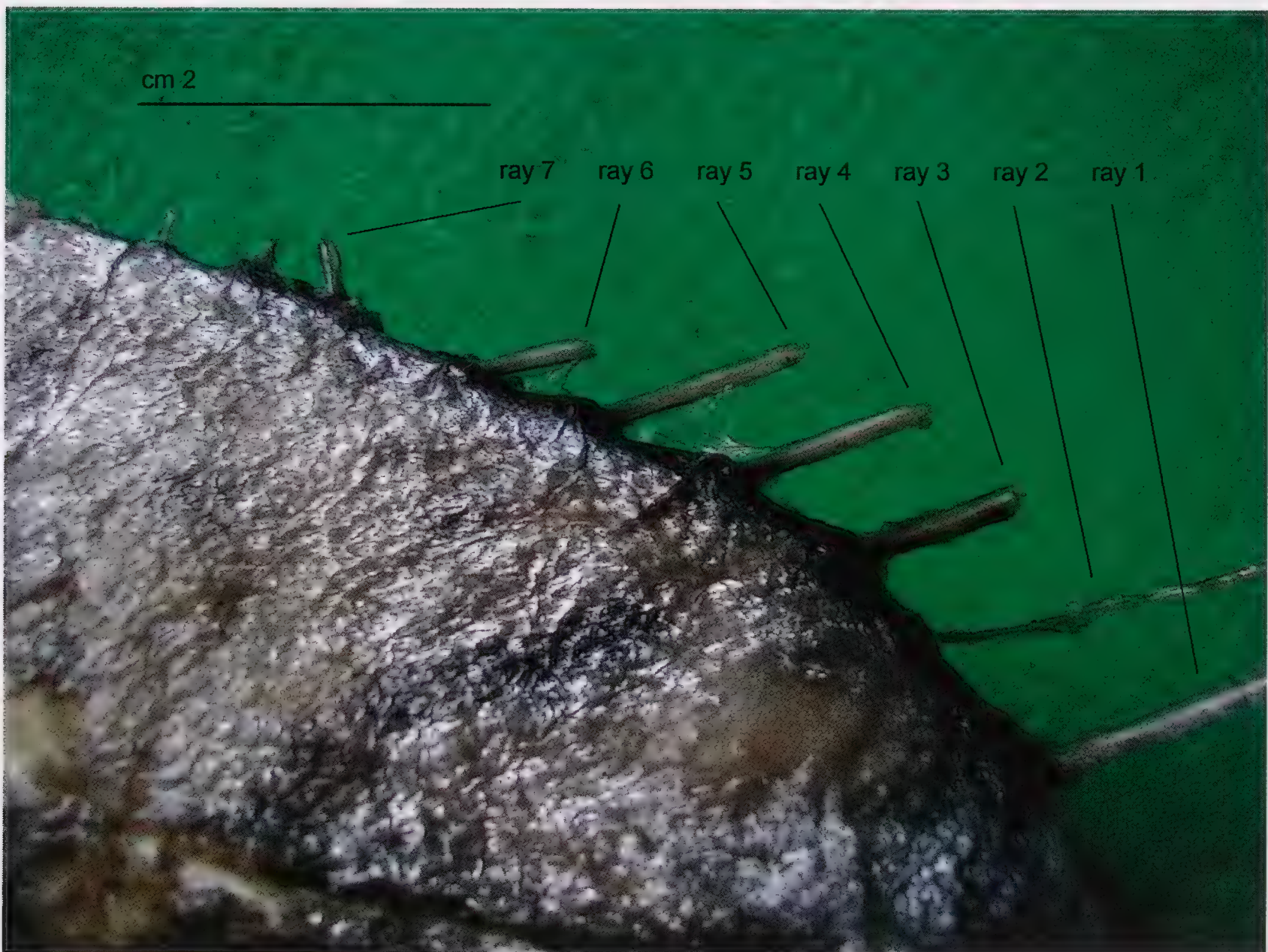


Figure 7 – Detail of the occipital crest in MSNG 53664 (Arenzano) specimen.

life cycle of regalecid fishes. The above mentioned individuals were among the only ones to show an intact caudal end with 4-5 minute spiny nubbins on the upper edge (see Figure 8). These structures may be rudiments deriving from caudal rays which are generally present on juvenile individuals (HEEMSTRA 1986).

Some authors have discussed whether the oarfish presence in the Mediterranean is due to the ingression of oceanic individuals or whether this sea possesses a stable resident population of the species (VINCIGUERRA 1918). This is difficult to say considering that *R. glesne* is an elusive mesopelagic fish whose biology and ecology are still poorly understood. However, the finding of eggs and young individuals at different stages of development is indicative of a self-maintaining Mediterranean population. In addition, the Ligurian Sea offers the ideal trophic conditions for a filter-feeder, as the oarfish appears to be (HUTTON 1961; HEEMSTRA 1986). Filter-feeding among Mediterranean oarfishes is confirmed by the stomach contents examined in the present study, as stressed also by other authors in the past (ORSI RELINI & RELINI 1993).

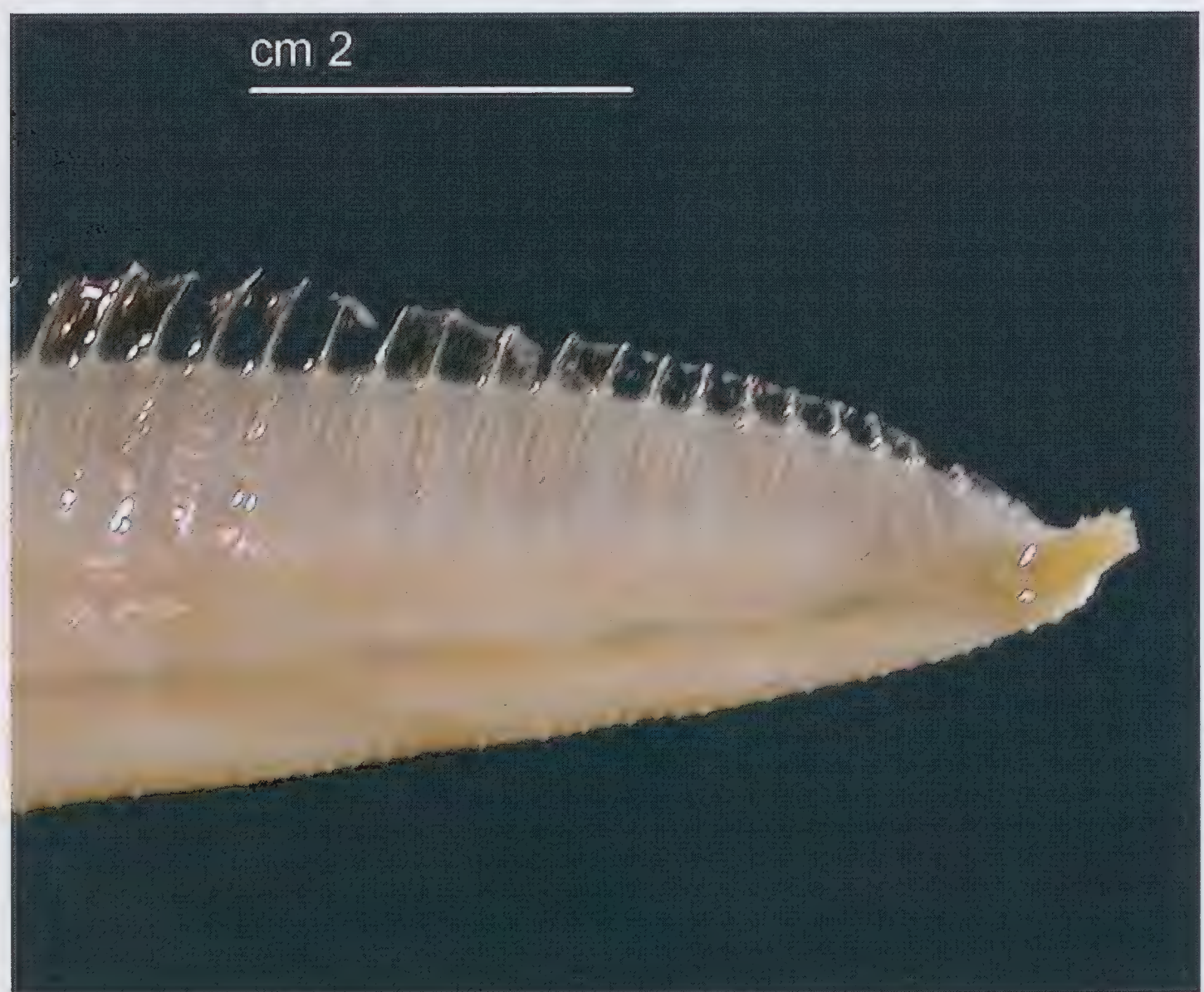


Figure 8 – MSNG 12307 (Noli) specimen: caudal end with spiny nubbins visible on upper edge.

The Liguro-Provençal waters present important upwelling phenomena (ASTRALDI *et al.* 1995; MILLOT 1999). These oceanographic features allow the creation of a highly dynamic ecosystem, in which large masses of euphausiids and other zooplanktonic organisms play a fundamental role in the food web. The establishment of peculiar trophic conditions all throughout the year could explain the more frequent occurrence of open water zooplanktivorous species like *R. glesne* and of many other top predators species, just like cetaceans, tunas, swordfish and elasmobranchs (ORSI RELINI *et al.* 1995; AA.VV. 2007). The general topography of this Mediterranean sector, characterized by a narrow continental shelf connected to bathyal grounds by numerous steep canyons (CORRADI *et al.* 1987), may also contribute to the unusual abundance of oceanic oarfishes. It is interesting to note that oarfish findings within the Ligurian Sea have occurred mainly in winter and spring, when planktonic production in this area is at highest levels (FABIANO 1982).

Concerning the taxonomy of the oarfish, it is still not certain if there is one or more species within the genus *Regalecus*. Therefore, it is very important that any specimen captured or washed ashore should be immediately reported to the nearest scientific institution and studied by a specialist. It is also greatly desirable that a major revision of the genus *Regalecus* should be undertaken as soon as possible.

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Finally this article is dedicated to the everlasting memory of “my little darling” Giulia Psomadakis.

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ABSTRACT

The description of a regalecid fish which came ashore in the harbour of Arenzano (Gulf of Genova) on 14 February 2003 is given. The specimen, found moribund on the sea surface, was gathered and stored for study. Morphometric and meristic analyses were performed on the latter and compared with those of eight liquid-stored individuals of *Regalecus glesne* preserved in the Museo Civico di Storia Naturale "G. Doria" of Genova (MSNG) and in the Dipartimento per lo Studio del Territorio e delle sue Risorse, Università di Genova (Dip.Te.Ris.). Exclusive observations on the structure of the occipital crest and other interesting morphological features, among with some dietary data, are also presented. Although the taxonomy of the genus *Regalecus* is at present in a somewhat confused state, the Arenzano fish can be provisionally assigned to *Regalecus glesne* Ascanius, 1772.

RIASSUNTO

Note su *Regalecus glesne* presente nel Golfo di Genova e nelle acque Liguro-Provenzali (Mediterraneo nord-occidentale) (Pisces, Lampridiformes, Regalecidae).

In questo lavoro viene documentato il ritrovamento di un *Regalecus* nel porticciolo di Arenzano (Golfo di Genova). Sull'esemplare, raccolto moribondo in acque superficiali il 14.II.2003, sono state eseguite dettagliate analisi morfometriche e meristiche. I dati ottenuti sono stati confrontati con quelli ricavati da otto esemplari di *Regalecus glesne* conservati in alcool e appartenenti alle collezioni del Museo Civico di Storia Naturale "G. Doria" di Genova (MSNG) e del Dipartimento per lo Studio del Territorio e delle sue Risorse, Università di Genova (Dip.Te.Ris.). Vengono presentate interessanti osservazioni morfologiche, incluse alcune inedite relative alla struttura della cresta occipitale e sulle abitudini alimentari. Nonostante il genere *Regalecus* sia attualmente contraddistinto da incertezze tassonomiche, il regaleco di Arenzano può essere provvisoriamente attribuito a *Regalecus glesne* Ascanius, 1772.

RESUMÉ

Notes sùr *Regalecus glesne* présent dans le Golfe de Genova et dans les eaux Liguro-Provençales (Méditerranée nord-occidental) (Pisces, Lampridiformes, Regalecidae).

La description d'un poisson du genre *Regalecus* qui est entrée dans le petit port d'Arenzano (Golfe de Genova) le 14 Février 2003 est donnée. L'exemplaire, trouvé moribond sur la surface de la mer, a été recueilli et conservé dans le but de l'étudier. Cet individu a été analysé et ses caractéristiques morphométriques et méristiques ont été comparées avec celles des huit individus de *Regalecus glesne*, conservés en alcool dans le Museo Civico di Storia Naturale "G. Doria" de Genova (MSNG) et dans le Dipartimento per lo Studio del Territorio e delle sue Risorse, Università di Genova (Dip.Te.Ris.). Le travail présent des observations morphologiques, compris des intéressantes remarques sùr la crête occipital et sùr le régime alimentaire. Bien que la taxonomie du genre *Regalecus* est à ce jour en quelque sorte confuse, le poisson de Arenzano peut provisoirement être attribué à *Regalecus glesne* Ascanius, 1772.